PATENT
Docket No.: 015258-063900US

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TOWNSEND and TOWNSEND and CREW LLP

By: Lisa Jeanetta
Lisa Jeanetta

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Gerard BARBEZAT, Arno REFKE and Michael LOCH	Confirmation No. 4308
Application No.: 10/509,850	Examiner: Katherine A. Bareford
Filed: September 30, 2004	Technology Center/Art Unit: 1792
For: PLASMA SPRAYING METHOD	DECLARATION OF KONSTANTIN VON NIESSEN UNDER 37 CFR § 1.132
Customer No. 20350	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Konstantin von Niessen, being duly warned that willful false statements and the like are punishable by fine or imprisonment or both, under 18 U.S.C. § 1001, and may jeopardize the validity of the patent application or any patent issuing thereon, state and declare as follows:

All statements herein made of my own knowledge are true, and statements made on information or belief are believed to be true and correct.

I am currently the Project Manager in the research and development department of Sulzer Metco. Prior to that, I have held the following positions: (1) PhD candidate at the University of Stuttgart, where my PhD thesis was entitled: "Thermal

Spraying as Innovative Process for Coating Textiles"; (2) Research assistant and Assistant Professor at the Institute for Manufacturing Technologies of Ceramic Components and Composites at the Department of Surface Engineering, thermal spaying at the University of Stuttgart; (3) Project manager for various industrial and public funded research programs at the University of Stuttgart; and (4) Assistant dean of the faculty of Production and Engineering Design at the University of Stuttgart.

I hold a PhD in Mechanical Engineering and a Graduate Engineers Degree (Dipl. –Ing.) in Mechanical Engineering from the University of Stuttgart.

My current research interests are in the fields of equipment and materials for thermal spray and thin film; coating services for thermal spray and thin film; plasma heat-treatment services; engine components for industrial and aero turbines and friction linings. A brief version of my *Curriculum Vitae* is attached as Exhibit A.

I have reviewed and analyzed the above-referenced patent application, and I am familiar with the contents therein.

I have read the Office Action dated March 2, 2009 received in the present case, and I have reviewed and analyzed the references cited therein by the Examiner.

WO 96/06200

The Office Action has rejected several of the pending claims under 35 U.S.C. § 103(a) as allegedly being obvious over WO 96/06200, hereinafter '200. The Office Action states that while the '200 reference does not specifically teach that at least 5 wt% of the particles are evaporated with part melting, or that conditions are controlled to provide an anisotropic columnar microstructure with elongate particles aligned substantially perpendicular to the substrate surface and transition regions with little material delimiting the particles relative to each other, however, '200 provides coating materials and conditions that overlap with that taught by applicant to provide such results. And that therefore, it would be inherent that the enthalpy, vaporization, part melting and

anisotropic structure would occur, or at least occur when the taught process conditions are optimized from the given range.

However, for the reasons set forth below, the Examiner's and the Office Action's concerns are overcome. The '200 reference does not disclose or suggest the vaporization of at least 5 wt% of the powder coating material, even though the operating ranges in the '200 may overlap with those of the present invention. It is not and it was not obvious at the time of the filing of the present patent application to operate in the regime that causes at least 5 wt% of the powder coating material to be evaporated.

A person of ordinary skill in the art at the time of the filing of the present patent application would have avoided any vaporization of the powdered coating material. And, the formation of the columnar structures that are made possible by being formed from the vaporized coating material was an unexpected result at the time of the filing of this patent application. The Low Pressure Plasma Spray Process (LPPS) as described in '200 may be operated using parameter ranges disclosed in '200 so as to not vaporize the powder. It should be noted that as soon as the parameters are not combined correctly, or by using a different powder or a different nozzle, the powder may be merely fused wherein the known thermic sprayed coatings composed of frozen liquid droplets are obtained.

While the specific operational parameters and grain sizes of the powder of the present patent application may lie within the ranges disclosed in '200, the formation of the vapor phase is an exception for the parameter ranges disclosed in '200 and is not an inherent feature of such parameters to cause the formation of the vapor phase.

While it may have been possible in '200 to get a small amount of vapor phase using the standard LPPS spray coating, in the standard deposition method the vapor

phase fraction will get lost as overspray and the resulting coating will consist completely, i.e. 100%, of (frozen) liquid droplets.

Therefore, the aim of the standard LPPS spray coating method is to avoid vaporizing the powder. Turning the standard method to one having a high amount of vaporized powder is not only not obvious, but is even illogical.

The formation of the vapor phase from the powder coating material allows for the columnar structure of the insulating layer that is formed from that vapor phase and which is formed by growing from the vapor phase, and only can be produced by growing from the vapor phase. Without the formation of the vapor phase nothing more than the dense homogenous layers which are formed from the frozen splashed droplets of liquid material would result.

Therefore, at the time of filing the present patent application it was not obvious to operate in the regime that causes at least 5wt% of the powder to vaporize and form a vapor cloud. Moreover one of skill in the art would have avoided vaporization because until the work of the inventors of the present application, the aim of using LPPS was the manufacture of dense homogenous layers using low pressure plasma spraying of liquid feed materials in the form of droplets resulting in layers of frozen splashed liquid material.

Accordingly, at the time of the filing of the present patent application, the possibility of using an LPPS-based method to form columnar structured layers that are formed from a vaporized powder cloud was an unexpected result.

The unexpected results of forming the columnar structured layers have many unexpected benefits over the typical homogenous layers that are formed by the prior known LPPS processes, such as those described in '200. As declared above, forming the thermally insulating layer in accordance with the method of the present

patent application causes the injected powder to not only melt into liquid droplets but also to evaporate the injected powder. With the evaporated powder, coatings are produced which show a unique columnar microstructure. The columns consists of many fine needles with a high defect density and high amount of internal porosity. With this morphology, the coatings have special characteristics which are very advantageous for gas turbine applications.

These columnar microstructures have proven to have a high strain tolerance in furnace cycling tests and offer a low thermal conductivity. Real gas turbine substrates have been coated to demonstrate the ability of the process of the present invention for the deposition of such coatings onto components with complex shapes. Ongoing economical evaluations for columnar coatings on turbine components under production conditions show a clear saving potential when using the process of the present invention. This technology offers a high potential to support the development of new coating solutions for improved thermal barrier coating systems and their application under production relevant conditions with an increased economical benefit.

Muehlberger (US5,853,815) in view of '200

The Office Action has rejected several of the claims under 35 U.S.C. § 103(a) as allegedly being obvious over Muehlberger (US5,853,815) in view of '200. The Office Action states that Muehlberger does not specifically teach at least 5 wt% of the particles are evaporated, or that conditions are controlled to provide an anisotropic columnar microstructure with elongate particles aligned substantially perpendicularly to the substrate surface and transition regions with little material delimiting the particles relative to each other. The Office Actions goes on to state that, however, '200 provides coating materials and conditions that overlap with that taught by the applicant to provide such results. However, for the reasons set forth below, the Office Action's and Examiner's concerns are overcome.

Muehlberger does not teach or suggest that at least 5 wt% of the particles are evaporated, or that conditions are controlled to provide an anisotropic columnar microstructure with elongate particles aligned substantially perpendicularly to the substrate surface and transition regions with little material delimiting the particles relative to each other. In several places, Muehlberger specifically teaches that the powder particles are heated to near melting conditions (col. 7, line 27; col.8, line 14; col. 9, line 25).

In addition, Muehlberger teaches a uniform dense and thin coating (col. 8, line 63) and not an anisotropic coating that has a columnar microstructure with elongate particles aligned substantially perpendicularly to the substrate surface and transition regions with little material delimiting the particles relative to each other.

And, as declared above, '200 does not teach or suggest that at least 5 wt% of the particles are evaporated, or that conditions are controlled to provide an anisotropic columnar microstructure with elongate particles aligned substantially perpendicularly to the substrate surface and transition regions with little material delimiting the particles relative to each other.

And as declared above, one of ordinary skill in the art at the time the invention was made would not modify Muehlberger as suggested by '200 because at the time of the invention all LPPS systems were designed to melt the coating material to deposit a uniform and dense coating and not to evaporate the coating material to allow for the formation of the uniquely microstructured coatings, which is deposited from the vapor phase of the coating material.

Furthermore, even if condition as suggested by the combination of references were employed and such that it may have been possible to get a small amount of vapor phase using the standard LPPS spray coating, in the standard deposition method the vapor phase fraction will get lost as overspray and the resulting coating will consist completely, i.e. 100%, of (frozen) liquid droplets.

Therefore, at the time the invention was made, the aim of the standard LPPS spray coating method was to avoid vaporizing the powder. Turning the standard method to one having a high amount of vaporized powder is not only not obvious, but is even illogical, as such a modification would prevent the formation of the dense and uniform coatings which were to be deposited by the LPPS technique.

The formation of the vapor phase from the powder coating material allows for the columnar structure of the insulating layer that is formed from that vapor phase and which is formed by growing from the vapor phase, and only can be produced by growing from the vapor phase.

Therefore, at the time of filing the present patent application it was not obvious to operate in the regime that causes at least 5wt% of the powder to vaporize and form a vapor cloud. Moreover one of skill in the art would have avoided vaporization because until the work of the inventors of the present application, the aim of using LPPS was the manufacture of dense homogenous layers using low pressure plasma spraying of

liquid feed materials in the form of droplets resulting in layers of frozen splashed liquid material.

Muehlberger (US5,853,815) in view of '200 and Zheng (US5,817,372)

The Office Action has rejected several of the claims under 35 U.S.C. § 103(a) as allegedly being obvious over Muehlberger (US5,853,815) in view of '200 and further in view of Zheng. The Office Action relies on Zheng for the teaching of a gas turbine substrate, a nickel or cobalt base alloy, heat treating and an yttria stabilized coating.

As declared above, '200, Muehlberger, or a combination of these two references do not teach or suggest that at least 5 wt% of the particles are evaporated, or that conditions are controlled to provide an anisotropic columnar microstructure with elongate particles aligned substantially perpendicularly to the substrate surface and transition regions with little material delimiting the particles relative to each other.

Zheng's teachings do not address these deficiencies of '200, Muehlberger, or a combination of these two references. Moreover, Zheng's teachings do not teach the unexpected results of evaporating the powder and forming the columnar microstructures from the vapor phase; nor does Zheng teach the unexpected benefits of forming such columnar microstructures which have been formed from the vapor phase.

The declarant has nothing further to say.

K.v. Niessen ____________ 2009/08/27 ____________
Konstantin von Niessen Date

Appendix A

Konstantin von Niessen
Date of birth: 19.08.1972 (Essen, Germany)
Married
3 children

Professional experience

Since 04/2006	Sulzer Metco AG (Schweiz) Project manager in the research and development department of Sulzer Metco
	University of Stuttgart
April 2006	PhD (Dr.-Ing.) „Thermisches Spritzen als innovatives Verfahren der Textilbeschichtung“ "Thermal spraying as innovative process for coating textiles"
01/2001 to 04/2006	Research assistant and assistant professor at the Institute for Manufacturing Technologies of Ceramic Components and Composites Department of Surface Engineering, thermal spaying
01/2003 – 04/2006	Project manager for various industrial and public funded research programs
01/2001- 12/2002	Assistant dean of the faculty of Production and Engineering Design

Education

1994 to 2000	Graduate Engineer (Dipl.-Ing.) Mechanical Engineering University of Stuttgart